*Simple Machines* Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Calculating Mechanical Advantage**

**Directions :** Use the provided background information to solve the math problems on the following page.

**Background:**

We use simple machines every day to make work easier. We use inclined planes to lift heavy objects. We use screws such as car jacks to change flat tires. These machines are able to make work easier by multiplying the amount of effort put into them, also known as the **effort force**. By multiplying the effort force, a simple machine is able to overcome the **resistance force**, or the force that opposes the effort force and the force of the machine. The number of times the machine multiplies the effort force is called its **mechanical advantage**. The most basic equation used to calculate mechanical advantage is as follows:

Mechanical Advantage = Resistance Force

Effort Force

We must now consider how to calculate mechanical advantage for each type of simple machine. Below are the equations needed to calculate mechanical advantage for each simple machine.

**Lever** : Mechanical Advantage = length of effort arm

length of resistance arm

**Pulley**: Count the number of rope segments that exert an upward

force on the object being moved.

**Wheel and Axle**: Mechanical Advantage = radius of wheel

radius of axle

**Inclined Plane**: Mechanical Advantage = length of slope

(Includes wedge height of slope

and screw)

**Questions**:

1. A crow bar (lever) is often used to lift a large object. If the crowbar is

100 cm long and the object is 20 cm from the fulcrum, what is the mechanical advantage of the crowbar?

2. The wheel of a small dirt bike has a radius of 30 cm. The axle has a

radius of 20 cm. What is the mechanical advantage of the wheel and

axle?

3. You are using a ramp to move a heavy box into a moving truck. If the

mechanical advantage of the ramp is 2 and the ramp is 2.5 meters long,

how high is the slope of the ramp?

4. What is the mechanical advantage of the pulley seen here?



5. The mechanical advantage of a steering wheel is 15. If the radius of the

steering column (axle) is 5 cm, what is the radius of the steering wheel?